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Gravitational waves from a curvature-induced phase transition of a Higgs-portal dark matter sector

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Our latest study (2407.18845) investigates the possibility of generating gravitational waves (GWs) from a curvature-induced phase transition of a non-minimally coupled scalar field acting as dark matter, with a portal interaction to the Higgs field. This analysis is conducted within a dynamical spacetime framework, specifically during the transition from inflation to kination, while also examining the potential for triggering Electroweak symmetry breaking through this mechanism.

A comprehensive exploration of inflationary scales is carried out, considering both positive and negative values of the non-minimal coupling. The study further accounts for phenomenological and observational constraints on the Beyond Standard Model (BSM) couplings, ensuring consistency when the scalar field serves as spectator dark matter. Notably, kination enhances the GW amplitudes, significantly restricting the viable parameter space. While the resulting GW spectra typically reside at high frequencies for standard high-scale inflation, certain regions of parameter space allow for potential detection in future experiments, offering a testable link between early universe dynamics, dark matter physics, and gravitational wave cosmology.

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